

Madden-Julian Oscillation:

Recent Evolution, Current Status and Predictions



Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
5 August 2019

Overview

- The MJO remains weak and the Kelvin wave that was prominent last week has also weakened.
- Most dynamical models depict little eastward propagation of the MJO over the next two weeks. The GFS ensemble system is a notable exception to this, predicting the MJO to strengthen significantly during the next week.
- Tropical cyclone activity is expected to remain high over the western Pacific and below climatology in the eastern Pacific and Atlantic basins.

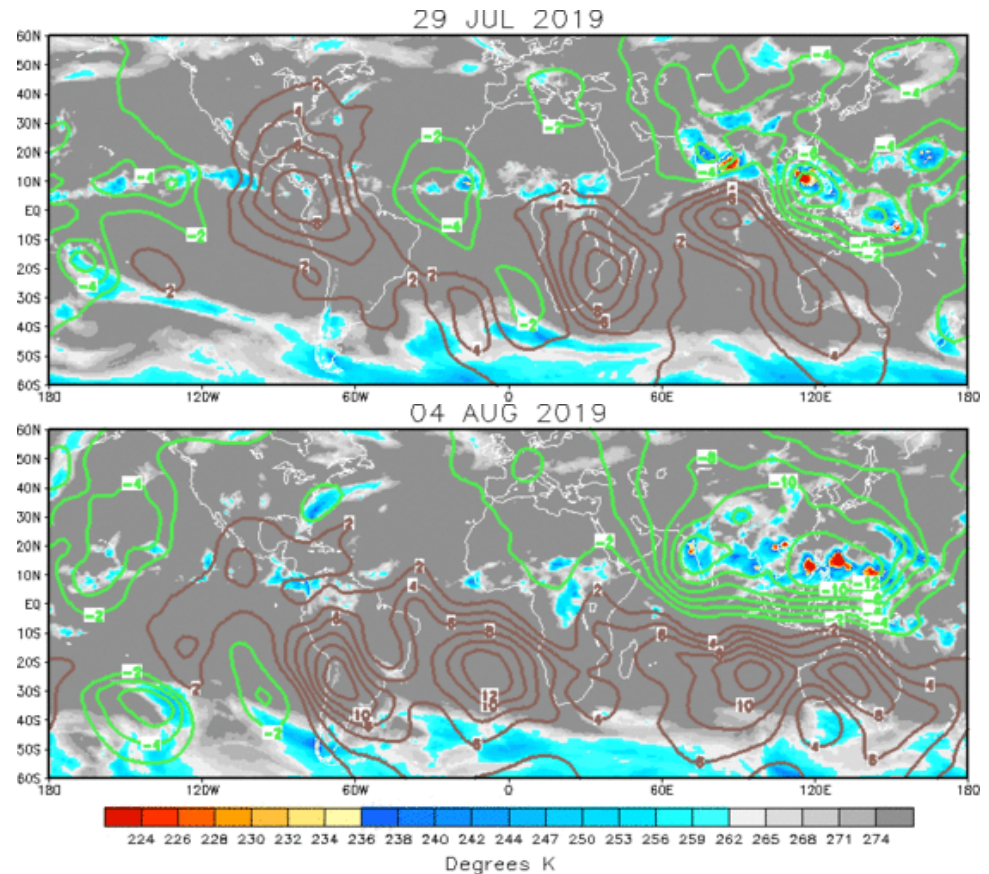
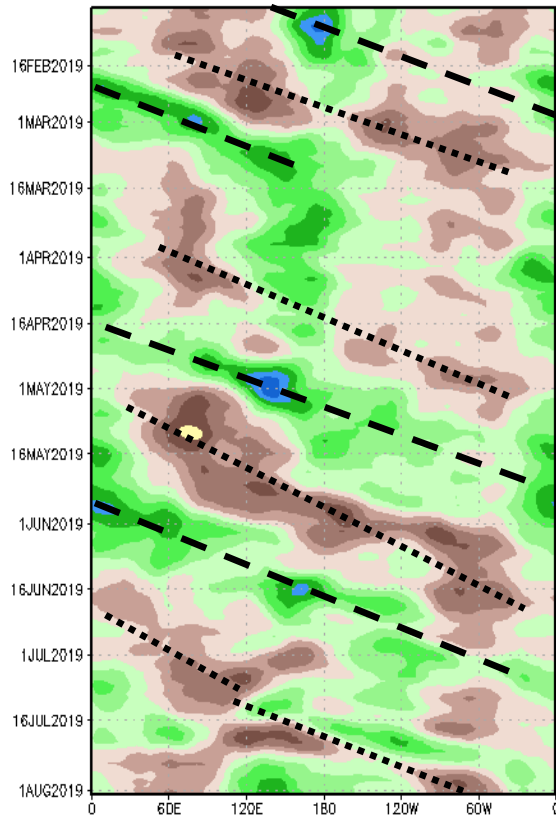
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php>

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation).

Brown shades: Anomalous convergence (unfavorable for precipitation).

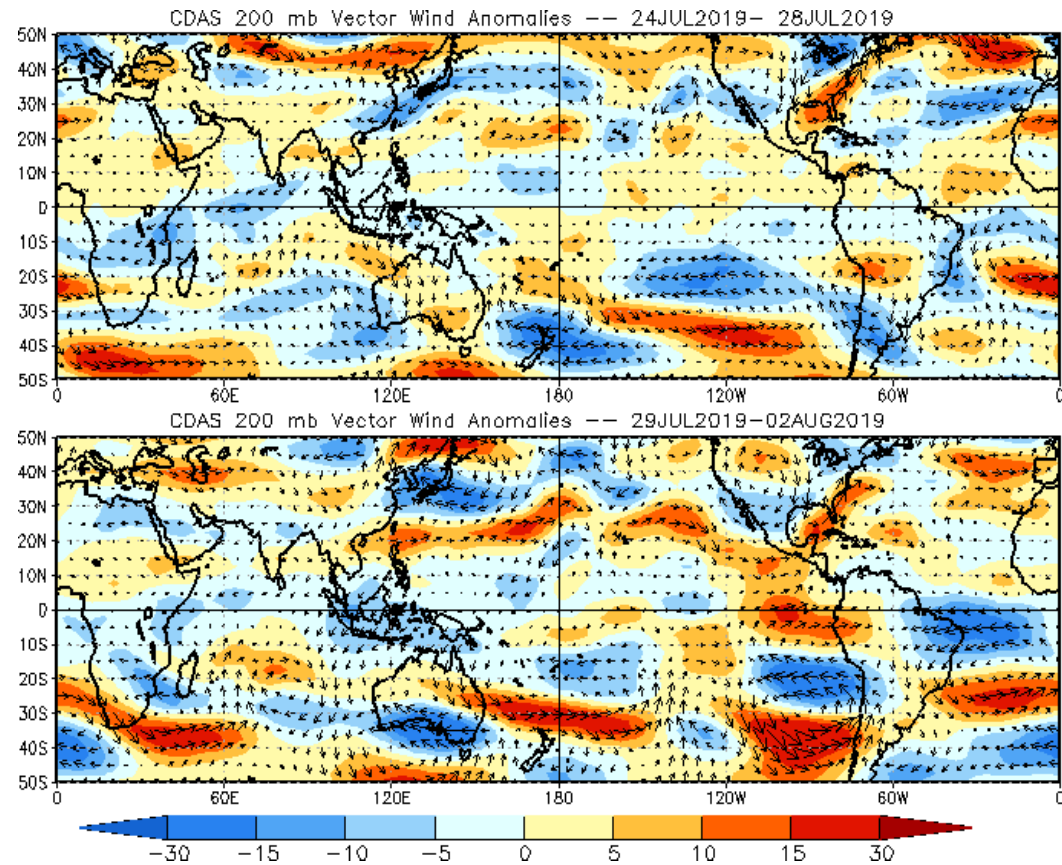
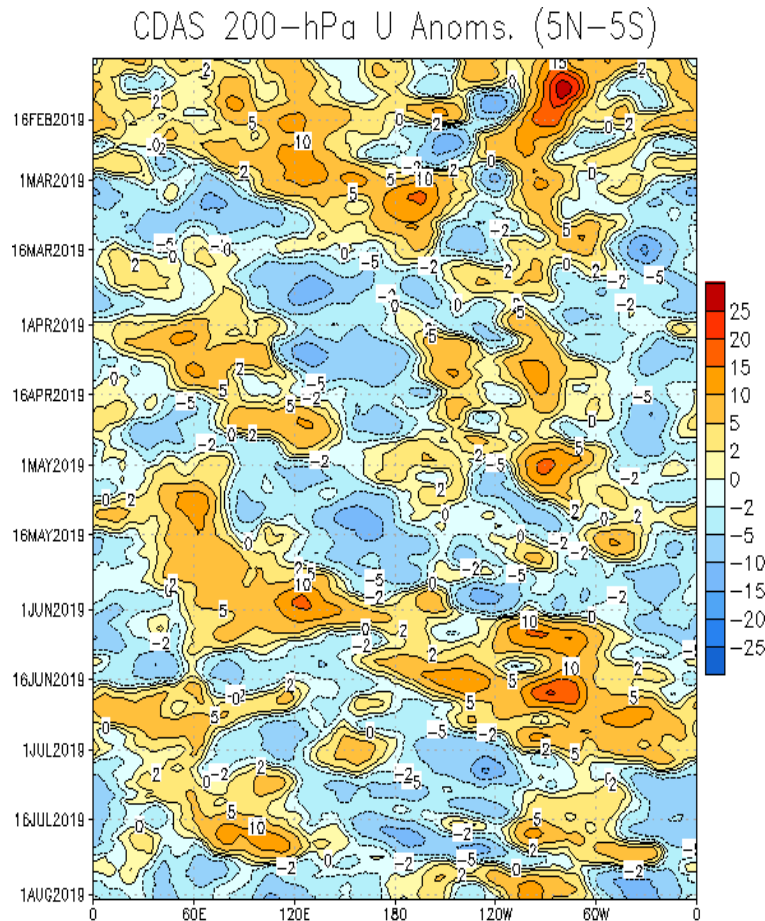
200-hPa Velocity Potential Anomaly: 5N-5S
5-day Running Mean



- Following two months of robust MJO activity, the intraseasonal signal became less well defined in July due to strong Rossby wave interference.
- The broad upper-level velocity potential field became stronger during the past week. Convection related to tropical cyclone activity has served to anchor the pattern over the western Pacific.
- There is no clear MJO signal in the upper-level velocity potential pattern.

200-hPa Wind Anomalies

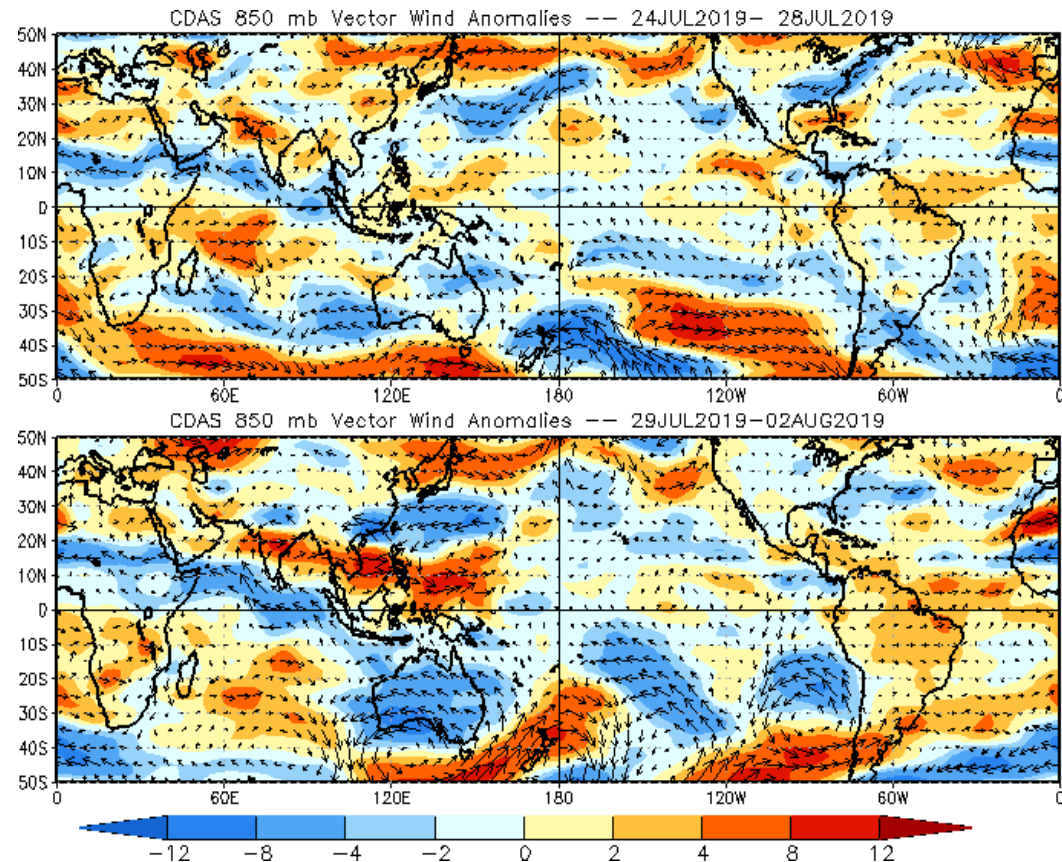
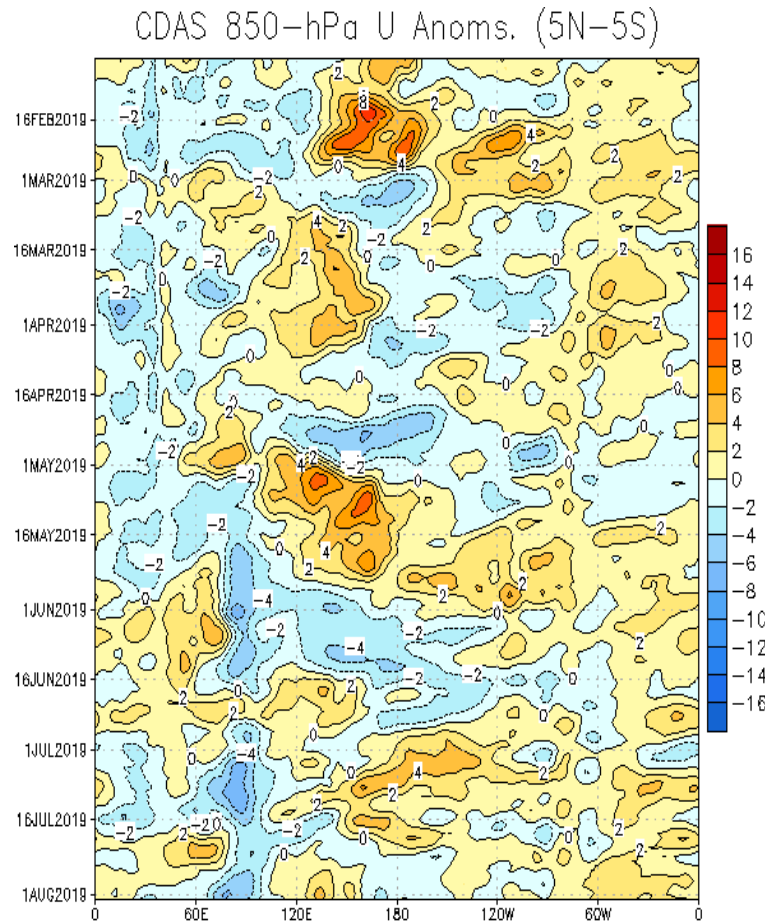
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- The upper-level pattern over the Pacific amplified during the past week.
- There is no indication of tropical wave activity in either the hovmöller or maps during the past week.

850-hPa Wind Anomalies

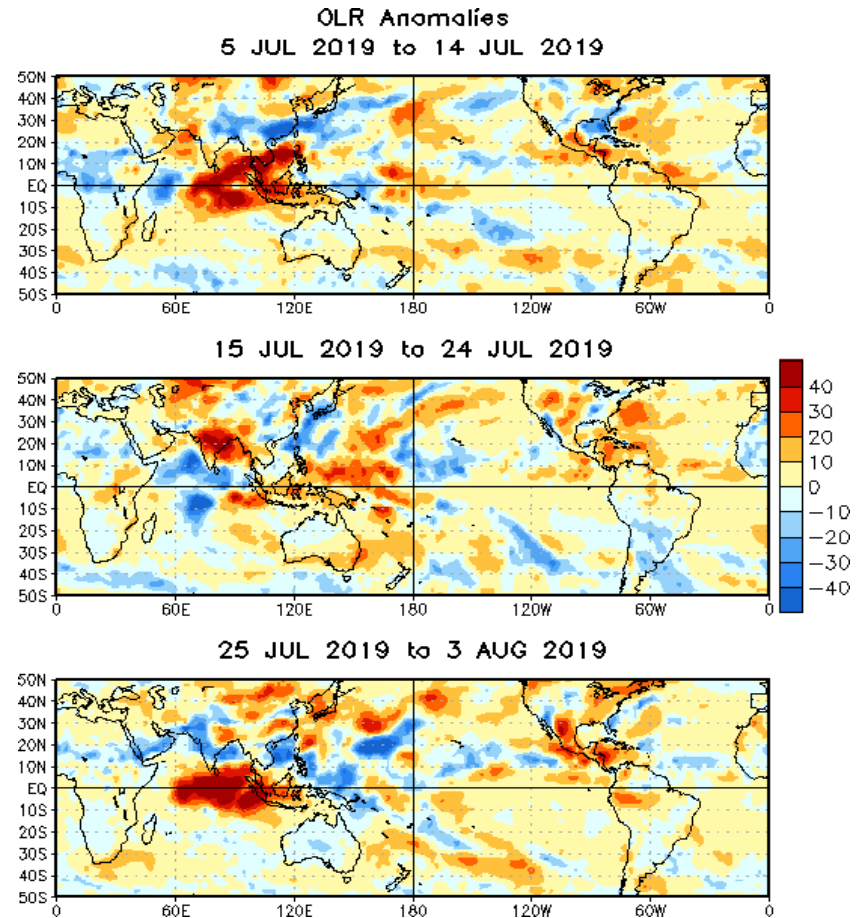
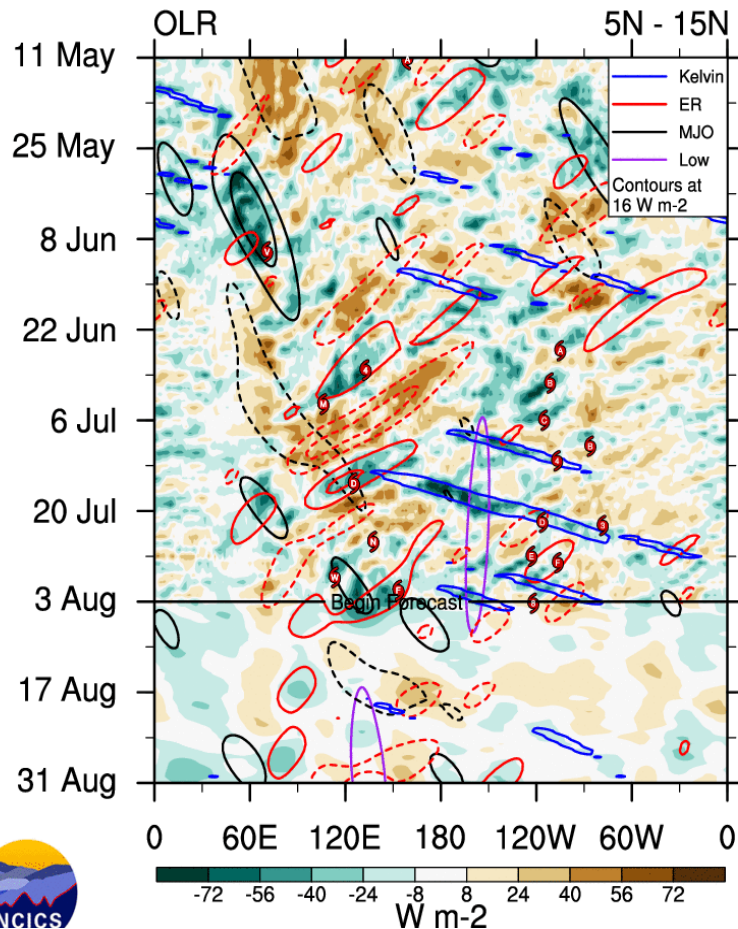
Shading denotes the zonal wind anomaly. **Blue shades:** Anomalous easterlies. **Red shades:** Anomalous westerlies.



- The overall low-level zonal wind field amplified over the western Pacific on both sides of the Equator.
 - This is mainly due to equatorial Rossby wave activity, which has provided a conducive environment for tropical cyclogenesis over the western Pacific.

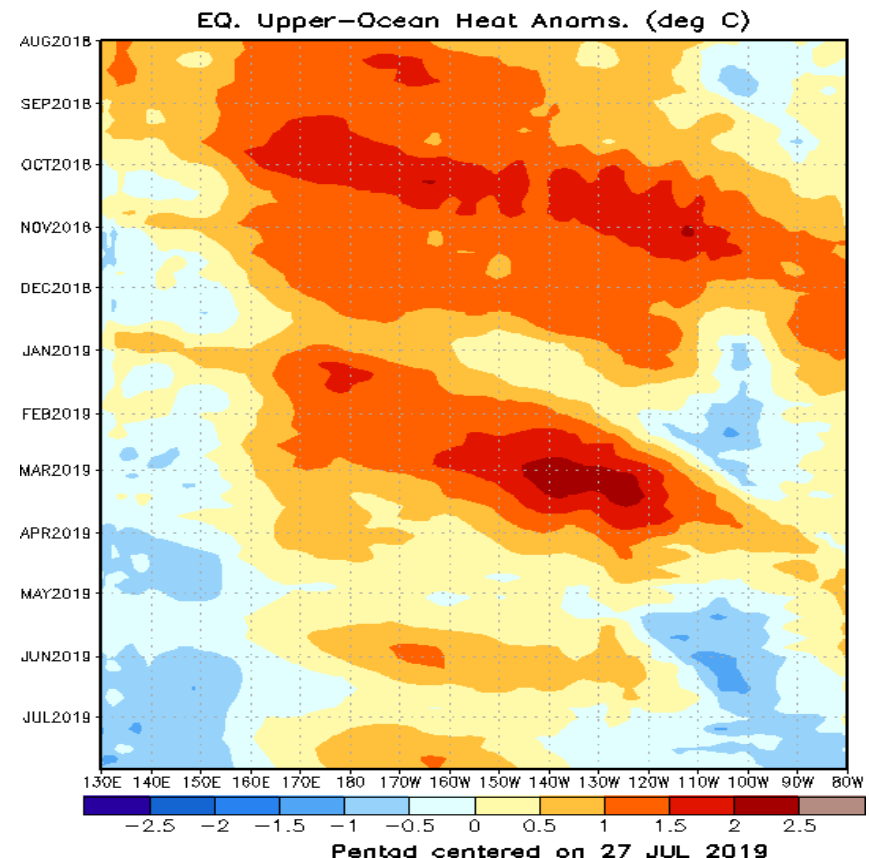
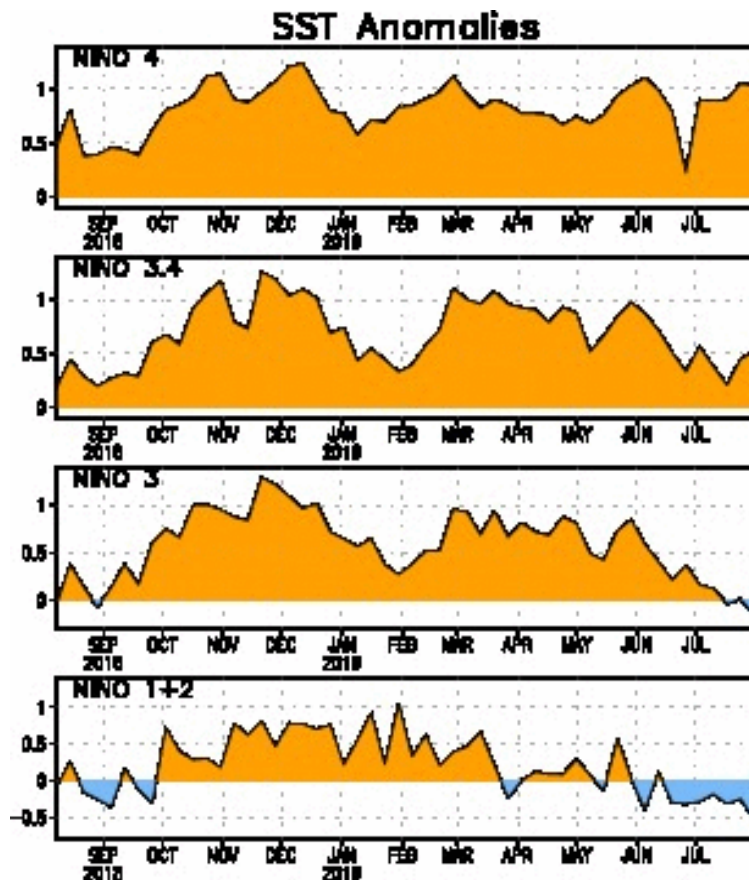
Outgoing Longwave Radiation (OLR) Anomalies

Blue shades: Anomalous convection (wetness). **Red shades:** Anomalous subsidence (dryness).



- A strong Kelvin wave crossing the Pacific and Western Hemisphere was the most coherent feature in the OLR field during the second half of July.
- A weak equatorial Rossby wave signal is evident over the western Pacific and is associated with at least two tropical cyclones.
- A large area of suppressed convection has developed over the Indian Ocean during the past week.

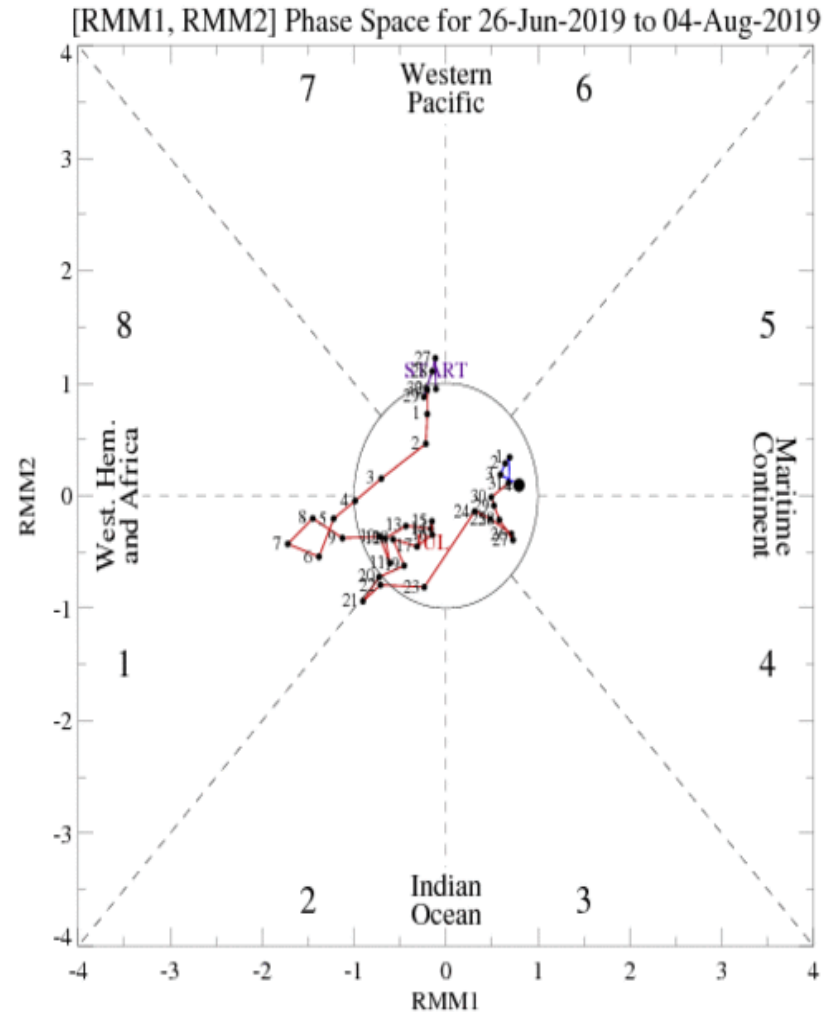
SSTs and Weekly Heat Content Evolution in the Equatorial Pacific



- Low amplitude SST anomalies remain above climatology across much of the equatorial Central and East Pacific, consistent with what remains of the ongoing El Niño event.
- A downwelling Kelvin wave event was evident over the central and eastern Pacific during mid-May through mid-June, but its amplitude was weaker than what was observed in previous events. Overall, upper-ocean heat content has continued to steadily decline over the past several months.
- Another weak downwelling wave has developed in response to recent period of anomalous westerlies over the central Pacific.

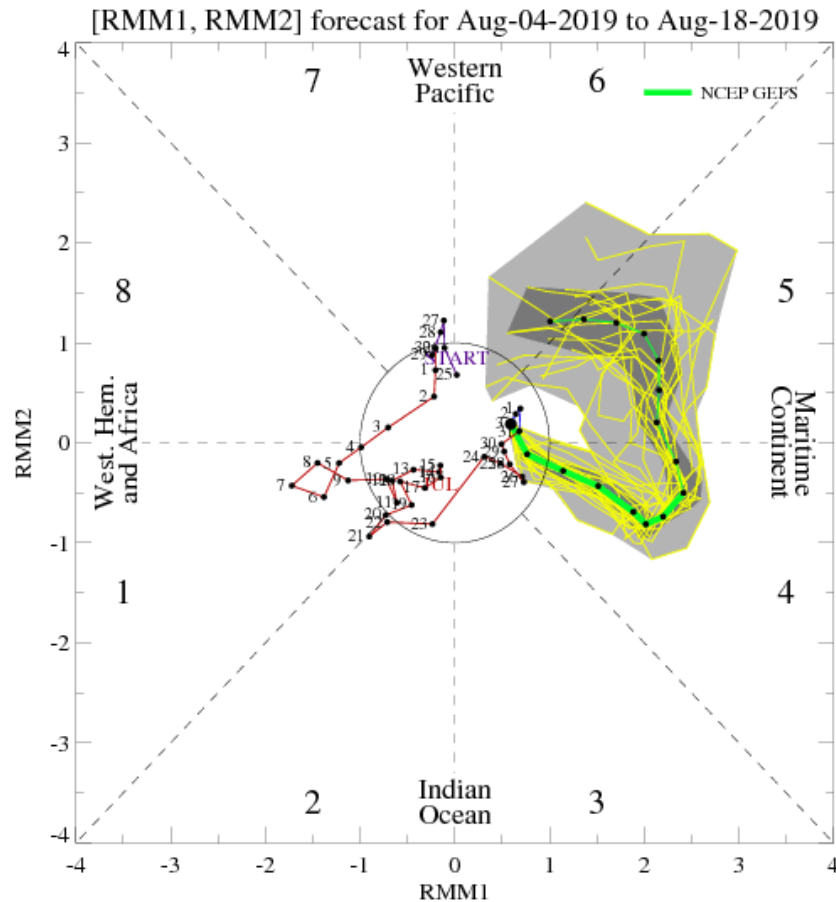
MJO Index: Recent Evolution

- The projection of the intraseasonal signal in RMM space remains weak.

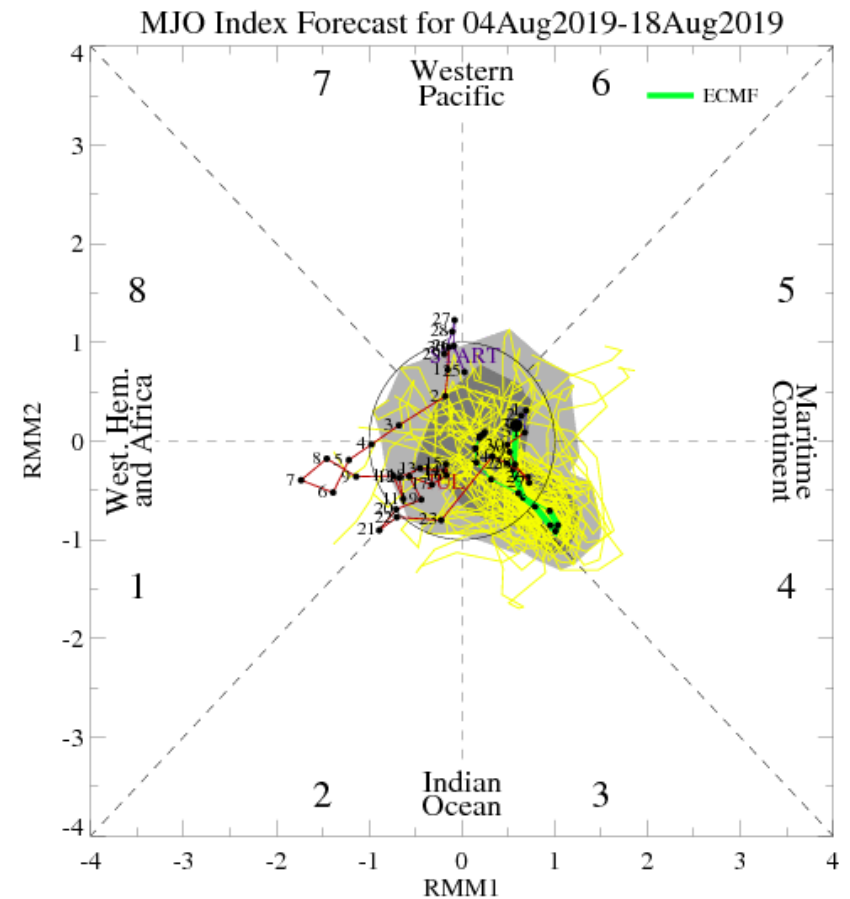


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



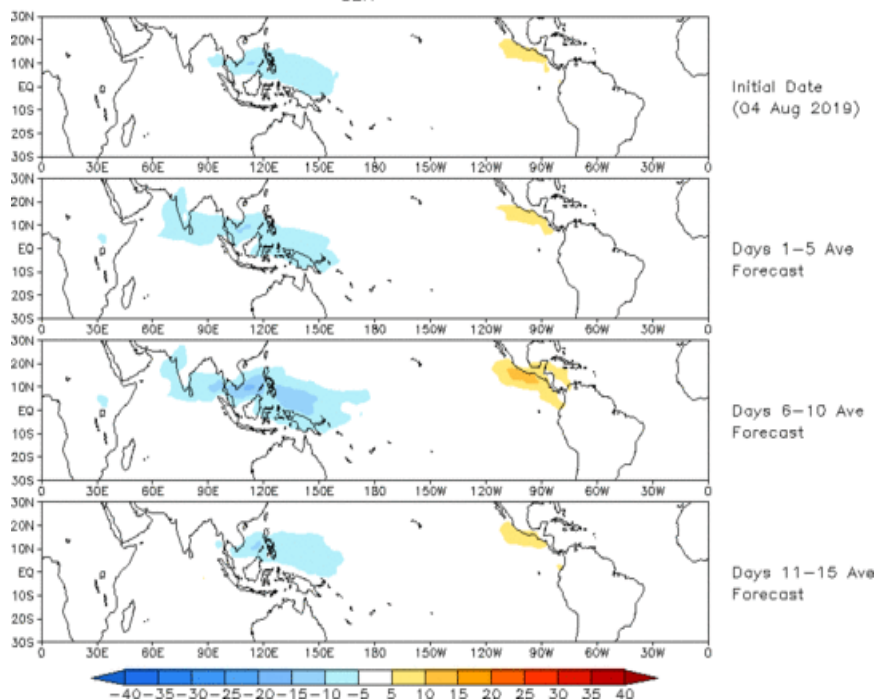
ECMWF Forecast

- The GEFS strongly amplifies the convective signal over the Indian Ocean during Week-1 and rapidly propagates it eastward during Week-2.
- The ECMWF forecast depicts greater variability among the ensemble members, but generally favors a weak MJO signal. Few ensemble members show robust eastward propagation of the signal.

MJO: GEFS Forecast Evolution

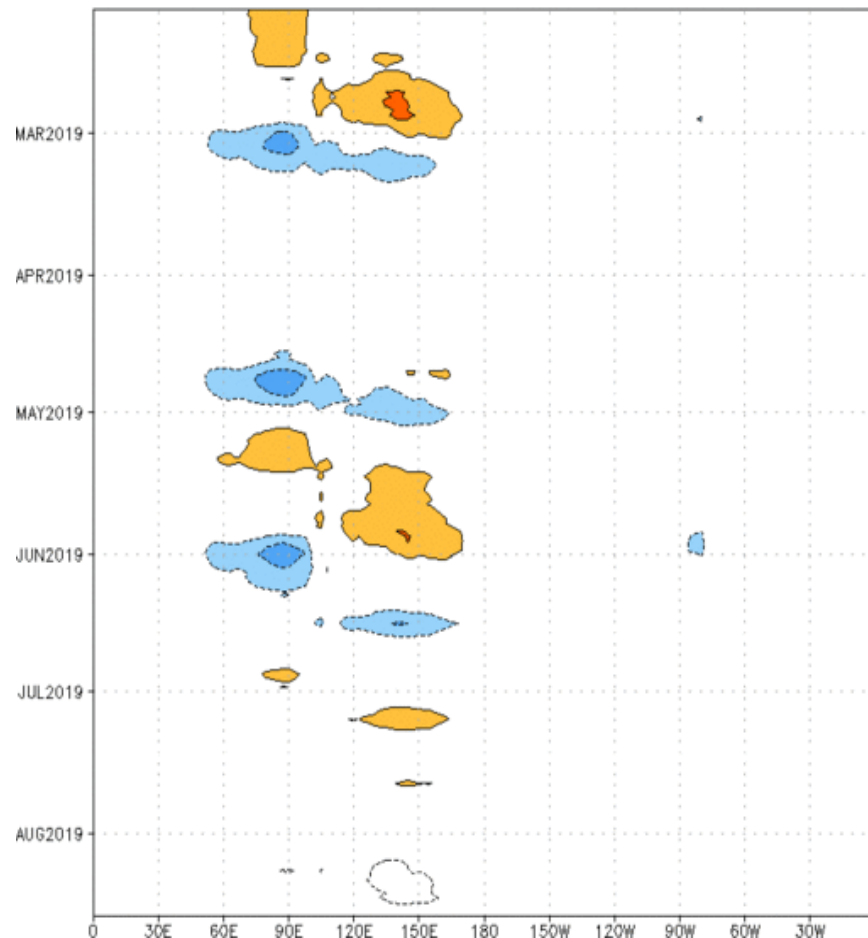
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

Prediction of MJO-related anomalies using GEFS operational forecast
Initial date: 04 Aug 2019
OLR



- The spatial depiction of OLR anomalies based on the GEFS RMM index shows a weakly amplified signal.

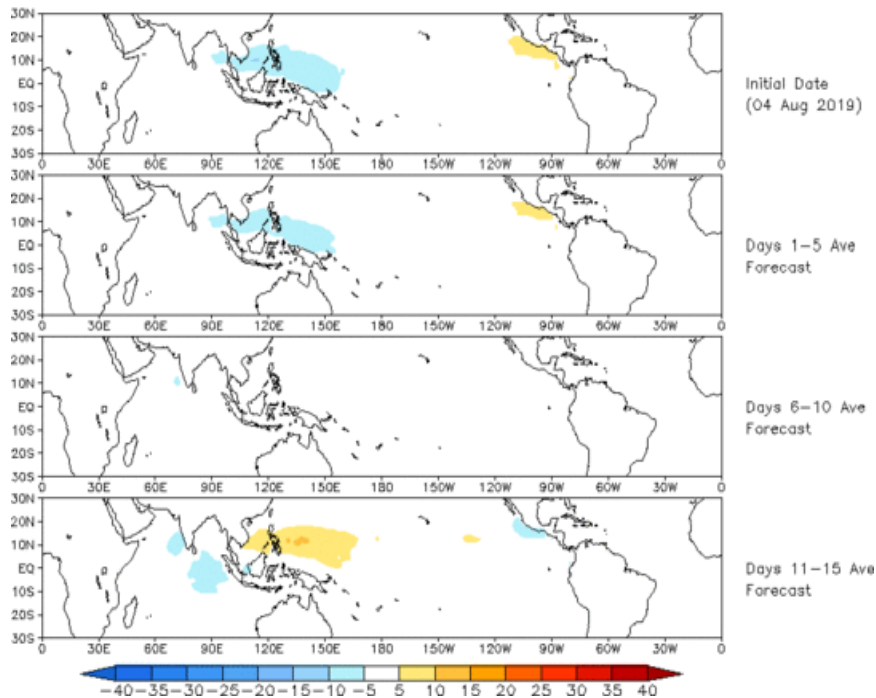
Reconstructed anomaly field associated with the MJO using RMM1 & RMM2
OLR [7.5°S,7.5°N] (cint:4Wm^{-2}) Period:02-Feb-2019 to 04-Aug-2019
The unfilled contours are GEFS forecast reconstructed anomaly for 15 days



MJO: Constructed Analog Forecast Evolution

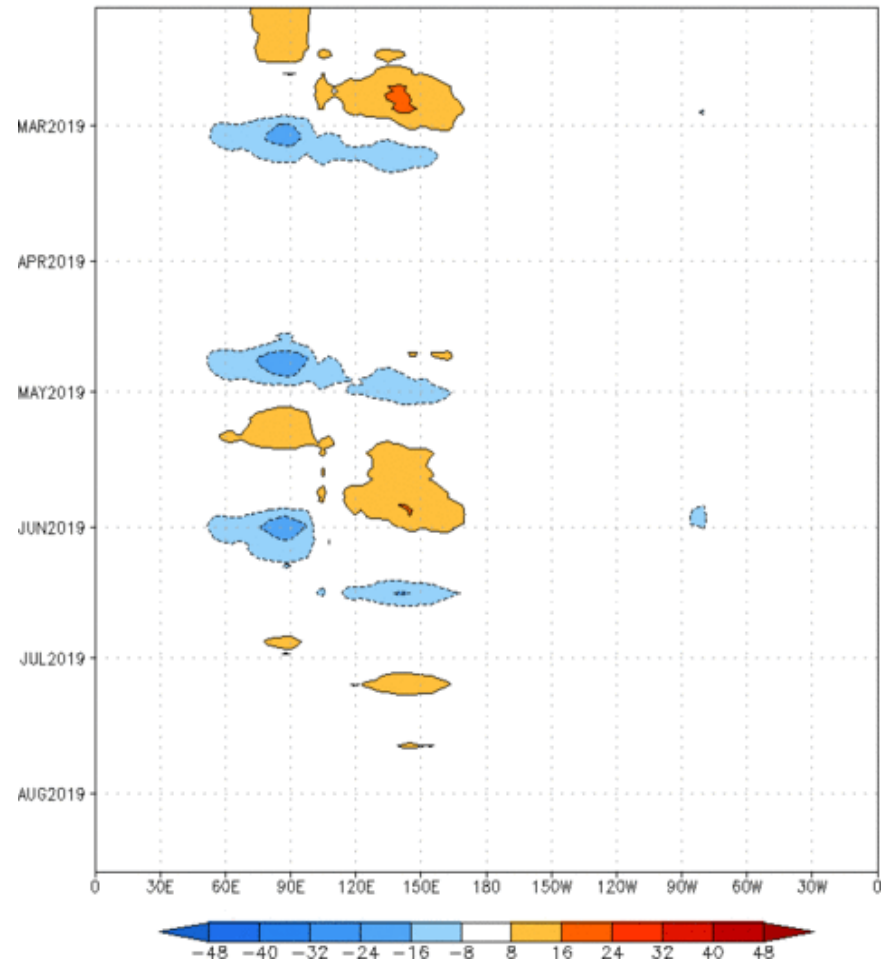
Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

OLR prediction of MJO-related anomalies using CA model reconstruction by RMM1 & RMM2 (04 Aug 2019)



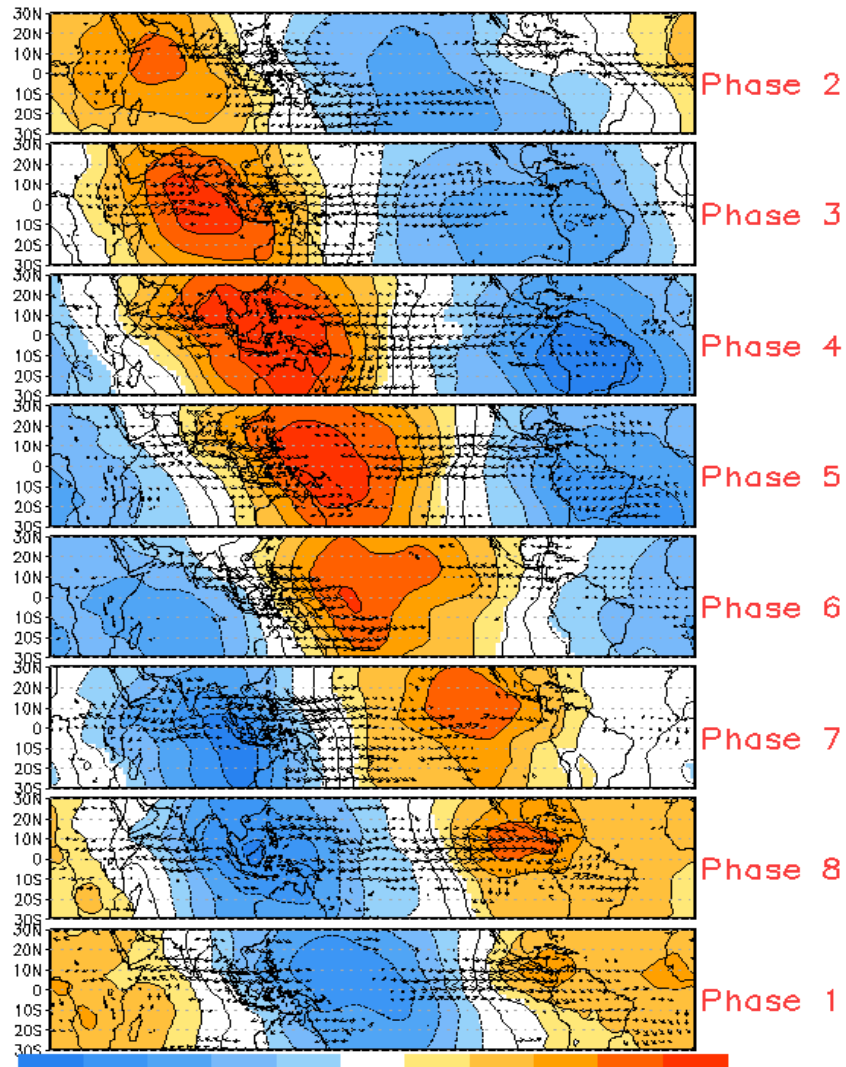
- The constructed analog MJO forecast also shows a stationary and weak predicted OLR signal.

Reconstructed anomaly field associated with the MJO using RMM1 & RMM2 OLR [7.5°S, 7.5°N] (cont: 4Wm⁻²) Period: 02-Feb-2019 to 04-Aug-2019
The unfilled contours are CA forecast reconstructed anomaly for 15 days

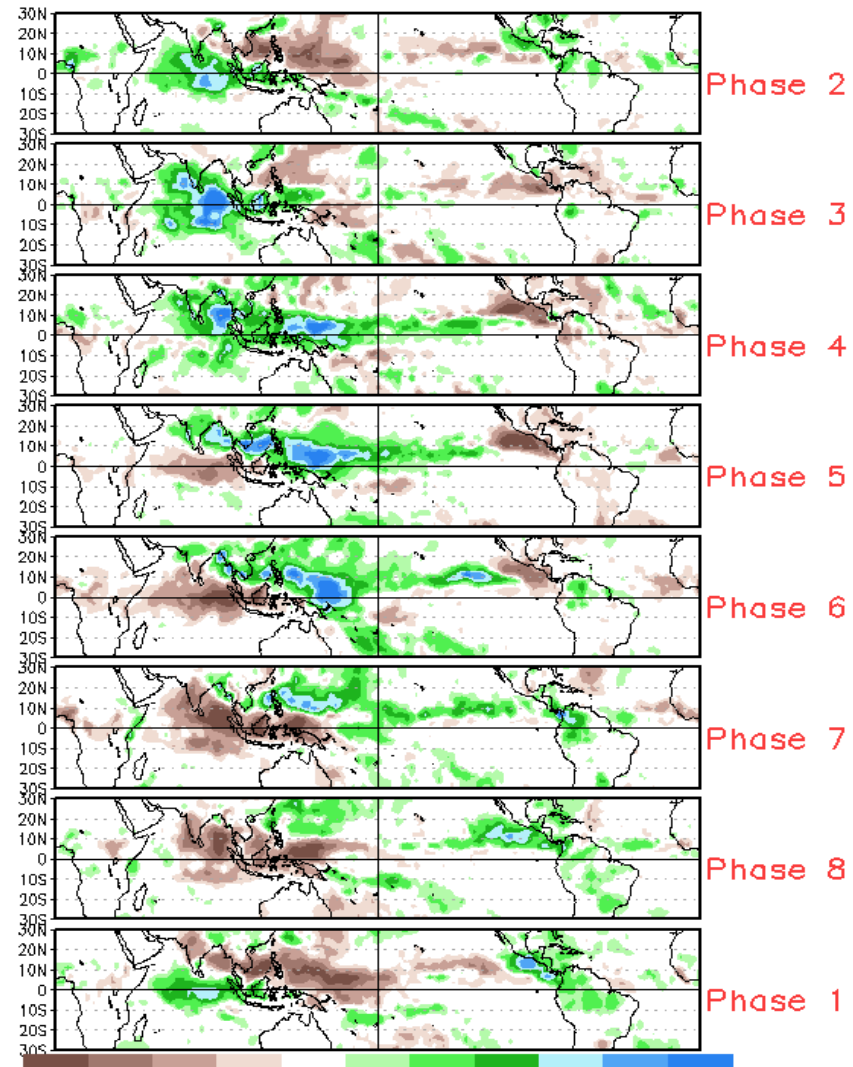


MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and
Wind Anomalies



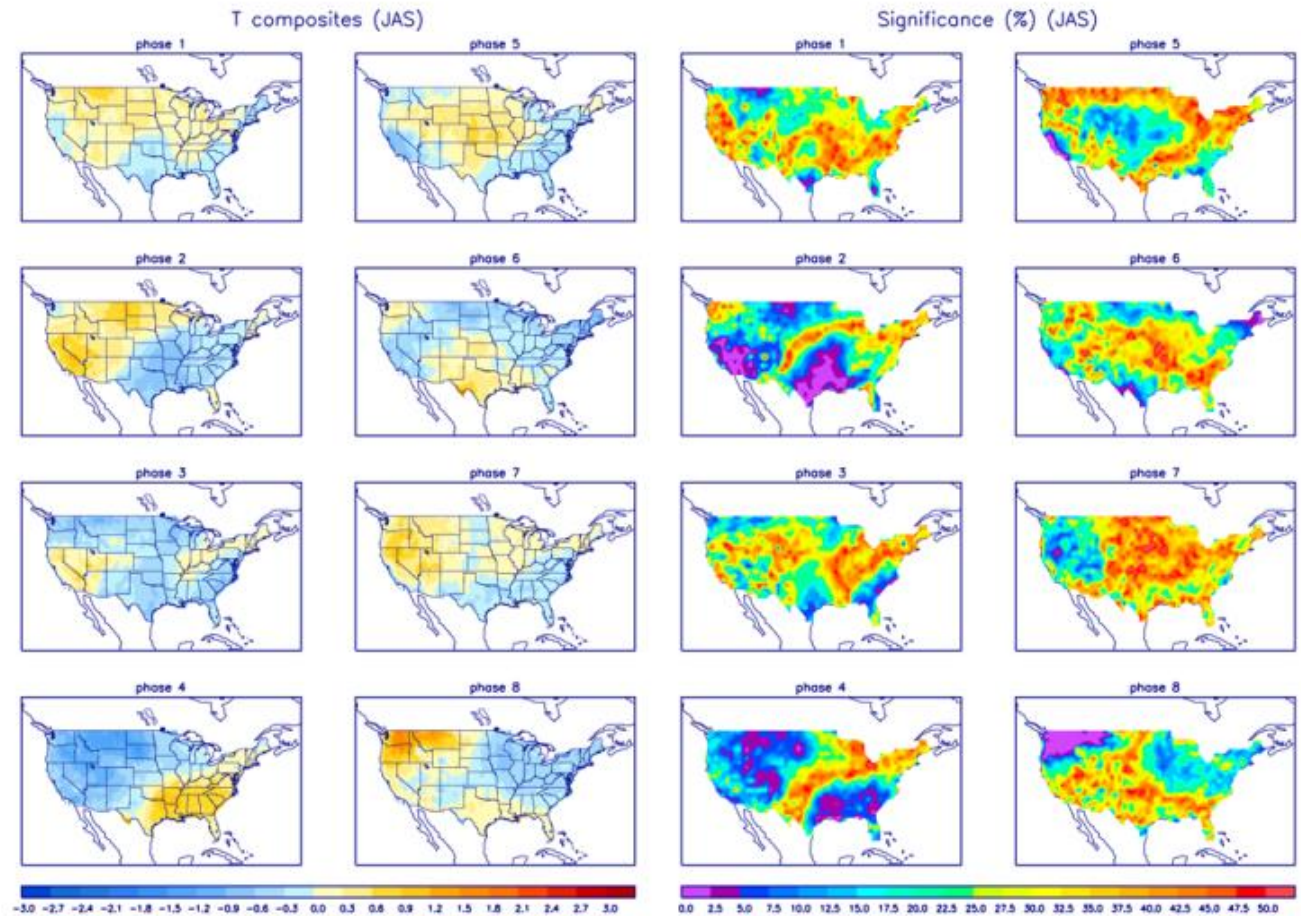
Precipitation Anomalies



MJO: CONUS Composite Maps by RMM Phase - Temperature

Left hand side plots show temperature anomalies by MJO phase for MJO events that have occurred over the three month period in the historical record. Blue (red) shades show negative (positive) anomalies respectively.

Right hand side plots show a measure of significance for the left hand side anomalies. Purple shades indicate areas in which the anomalies are significant at the 95% or better confidence level.



MJO: CONUS Composite Maps by RMM Phase - Temperature

Left hand side plots show precipitation anomalies by MJO phase for MJO events that have occurred over the three month period in the historical record. Brown (green) shades show negative (positive) anomalies respectively.

Right hand side plots show a measure of significance for the left hand side anomalies. Purple shades indicate areas in which the anomalies are significant at the 95% or better confidence level.

